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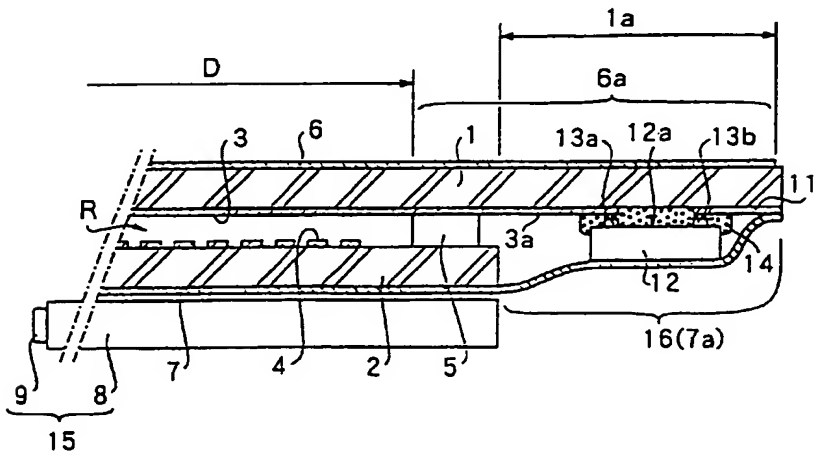
(54) LIQUID CRYSTAL DISPLAY AND ELECTRONICS EQUIPMENT USING THE SAME

(57) A liquid-crystal display device has a pair of substrates (1, 2) which are opposite to each other and a semiconductor element which is directly joined to the substrate (1). A portion other than an active surface (12a) of the surfaces of the semiconductor element (12) is covered with a light-shielding member portion (16). Since the light-shielding member (16) completely shields light irradiated from the upper and side surfaces of the semiconductor element (12) and a joint surface between the semiconductor element (12) and the substrate (1), the semiconductor element (12) can be prevented from being erroneously operated.

FIG. 1



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Description

[TECHNICAL FIELD]

The present invention relates to a liquid-crystal display device which controls the orientation of a liquid crystal to display visible information. More specifically, the present invention relates to a liquid-crystal display device in which a semiconductor element is directly packaged (mounted) on a substrate constituting a liquid-crystal panel. The present invention also relates to an electronic device on which the liquid-crystal display device is mounted.

[BACKGROUND ART]

In recent years, liquid-crystal display devices are popularly used in various devices such as a navigation system, a television set, a palm-top computer, an electronic organizer, and a portable telephone to display visible information. As a packaging method of packaging a semiconductor element, e.g., a driver IC, on a liquid-crystal panel in manufacturing a liquid-crystal display device, a packaging method of directly joining a semiconductor element to one of a pair of substrates which are opposite to each other through a liquid crystal, i.e., a COG (Chip On Glass) method, is known. When the COG method is used, reduction in thickness and weight of a liquid-crystal display device, a very fine (micropattern) connection pitch, and the like are expected. However, when the COG method is used, a semiconductor element is directly joined to a transparent substrate by a joining agent such as an ACF (Anisotropic Conductive Film). For this reason, light from a back light or sunlight may be directly irradiated on the semiconductor element through the substrate. The irradiated light may cause the semiconductor element to erroneously operate. The following problem is also posed. That is, light irradiated from a portion other than the active surface of a semiconductor element passes through the semiconductor element to adversely affect the active surface. As a result, the semiconductor element is erroneously operated. In order to prevent light from being irradiated on a semiconductor element packaged on a substrate by the COG method, the following conventional liquid-crystal display device is disclosed in Japanese Unexamined Patent Publication No. 1-128534. FIG. 8 is a view showing a typical example of a liquid-crystal display device of this type. In a metal film forming process step for forming an active element on a substrate, a metal film 51 is also formed in a region corresponding to an IC chip, i.e., a semiconductor element, and the metal film 51 is used as a light-shielding layer for the IC chip 12.

However, in the conventional liquid-crystal display device, light irradiated from the upper or side surface of the IC chip, i.e., a surface other than the active surface of the semiconductor element, and passing through the upper surface of the semiconductor element to adversely affect the active surface of the semiconductor element, and light being incident from the connection surface between a substrate on which the semiconductor element is packaged and the semiconductor element to adversely affect the active surface of the semiconductor element are not considered. The light-shielding effect is not perfect.

In addition, in the conventional liquid-crystal display device, a light-shielding layer is consequently formed between the IC chip and the substrate. For this reason, a process for reducing the capacitance formed between the IC chip and the light-shielding layer, e.g., a process of forming the light-shielding layer as a special pattern must be performed. However, this process may be complex, and light-shielding performance may be degraded because the light-shielding layer is formed in a special pattern.

[DISCLOSURE OF INVENTION]

The present invention has been made in consideration of the above problems in a conventional liquid-crystal display device, and has as its object to provide a liquid-crystal display device, using the COG method, in which light can be prevented from being irradiated on a semiconductor element by only performing an extremely simple process without performing any complex process.

In order to achieve the above object, according to the present invention, a liquid-crystal display device having a pair of substrates which are opposite to each other through a liquid crystal, and a semiconductor element which is directly joined to at least one of the substrates, is characterized in that a portion of the semiconductor element other than the surface joined to one of the substrates is covered with a light-shielding member.

In this liquid-crystal display device, a light-shielding member is not formed between a semiconductor element and a substrate, and a portion, other than the surface joined to the substrate, of the surfaces of the semiconductor element joined to the substrate is covered with a second light-shielding member. More specifically, the semiconductor element itself is shielded from light by the light-shielding member. With this arrangement, the light-shielding member arranged to cover the semiconductor element completely shields light irradiated from the upper and side surfaces of the semiconductor element and the joint surface between the semiconductor element and the substrate, so that the semiconductor element can be completely prevented from being erroneously operated.

One pair of substrates which sandwich the liquid crystal therebetween consist of transparent glass. However, if there is no inconvenience on manufacture, the substrates may consist of another material such as a transparent synthetic resin. As the semiconductor ele-

ment, for example, a driver IC for controlling scanning electrodes or data electrodes of a simple matrix type display device, or a driver IC for controlling scanning lines or data lines of an active matrix type display device, and the like can be considered. Although joining the semiconductor element to the substrate is not limited to a specific method, for example, the semiconductor element can be joined to the substrate by using an ACF.

The second light-shielding member for shielding light being toward the semiconductor element may be arranged on a surface opposite to the surface, to which the semiconductor element is joined, of the surfaces of one of the substrates. Although the second light-shielding member shields light irradiated from the active surface of the semiconductor element like a conventional light-shielding layer, after the semiconductor element is joined to the substrate, a light-shielding member is fixed to the opposite surface of the substrate. For this reason, the light-shielding member can be arranged by only performing an extremely simple process without performing any complex process. In addition, since the problem of a change in capacitance obtained by arranging the light-shielding member need not be considered, the light-shielding member can be formed in an arbitrary pattern. Therefore, light can be reliably prevented from being irradiated on the semiconductor element with sufficient light-shielding performance.

The present invention can be also be applied to a liquid-crystal display device of an active matrix type, or to a liquid-crystal display device of a simple matrix type. The active matrix type is a liquid-crystal display device using a format in which respective pixels arranged in the form of a matrix have an active element such as a TFT (Thin Film Transistor), a TFD (Thin Film Diode), or the like. On the other hand, the simple matrix type is a liquid-crystal display device using a format in which a plurality of pixels having no active elements are arranged in the form of a matrix between a pair of substrates which sandwich a liquid crystal material therebetween, and includes a liquid-crystal display device which has a sign pattern in response to a function request. The prior art disclosed in JP-A-1-128534 is on the assumption that the active matrix type is used, and a liquid-crystal display device of the simple matrix type is not considered. If the prior art is to be applied to the liquid-crystal display device of the simple matrix type, a cumbersome thin-film forming process step is assigned to form a metal light-shielding film in a region corresponding to an IC chip, cost uneconomical increases.

Therefore, when the present invention is applied to a liquid-crystal display device of the simple matrix type, a remarkable effect can be obtained. In the liquid-crystal display device of a so-called active matrix type, a light-shielding layer, i.e., a light-shielding member, for shielding the semiconductor element from light in the processing step of forming an active element on a glass substrate can be incidentally formed. However, since the step of forming an active element is not performed in the simple matrix type, a light-shielding layer cannot be incidentally formed.

As a method of joining a semiconductor element to a substrate, a so-called face-down method which joins the semiconductor element to the substrate such that the active surface of the semiconductor element faces the substrate, and a so-called face-up method which joins the semiconductor element to the substrate such that the surface opposite to the active surface of the semiconductor element is in contact with the substrate are considered. The present invention can be applied to the face-down method of the above two methods. When the face-up method is employed, a light-shielding member is not arranged to cover the semiconductor element from the upper surface, but the semiconductor element is joined to the substrate, and a light-shielding member is fixed to a position corresponding to the semiconductor element on the opposite surface of the substrate. In this case, as in the present invention, light irradiated from a surface other than the active surface side of the semiconductor element can be shielded.

According to the present invention, various concrete examples of a light-shielding member can be considered. For example, since a polarizing plate is fixed to the surface of a substrate in a general liquid-crystal display device, the size of the polarizing plate is made large to extend the polarizing plate to the outside of the effective display region of a liquid-crystal panel, i.e., a portion where the semiconductor element is packaged, and the extended portion can be used as the light-shielding member. Also, a sheet member having light-shielding properties is arranged to cover the semiconductor element, so that the light-shielding member can be constituted. The light-shielding member can also be formed such that the surface of a semiconductor element joined to a substrate is covered with a molding resin. When the semiconductor element is covered with a molding resin, the semiconductor element can be shielded from light. In addition, the semiconductor element is mechanically protected by the molding resin, or the semiconductor element can also be prevented from being exposed to humidity.

As a concrete example of the second light-shielding member, the following can be used. That is, like the above light-shielding member, the size of the polarizing plate is made large to extend the polarizing plate to the outside of the effective display region of a liquid-crystal panel, i.e., a portion where the semiconductor element is packaged, and the extended portion can be used as the light-shielding member. In addition, a sheet member having light-shielding properties may be stuck on the surface, which is opposite to the semiconductor element, of the substrate.

In addition, when one light-shielding tape having light-shielding properties and flexibility is adhered to the substrate such that the tape is bent around the substrate, the two functions of the light-shielding member

and the second light-shielding member can be achieved by one light-shielding tape. In this case, when a tape material having flexibility and elasticity is used as a light-shielding tape, the light-shielding tape can be attached to be in tight contact with the semiconductor element or the substrate. For this reason, the outside size of the liquid-crystal display device is not vainly increased, and operability can be improved.

According to the present invention, an electronic device in which a liquid-crystal display device having a pair of substrates which are opposite to each other through a liquid crystal and a semiconductor element which is directly joined to at least one of the substrates and a main body having a main substrate for sending an external input signal to the semiconductor element are connected to each other by a connection circuit substrate is characterized in that a portion other than a surface, which is joined to one of the substrates, of the surfaces of the semiconductor element is covered with a light-shielding member.

The electronic device is characterized in that a second light-shielding member for shielding light being toward the semiconductor element is arranged on a surface, opposite to the surface, to which the semiconductor element is joined, of the surfaces of one of the substrates to extend to an outside position of one of the substrates, and the extended portion of the second light-shielding member is arranged to overlap the connection circuit.

In an electronic device such as a portable telephone, it is required to assure the connection reliability of a connection circuit substrate for connecting a main body to a liquid-crystal display device. In the electronic device according to the present invention, the second light-shielding member is formed to extend to the outside portion of the substrate, and the extended portion is arranged to overlap the connection circuit substrate. For this reason, the strength of the connection substrate, especially, the strength of the connection portion, is improved. As a result, higher connection reliability can be obtained. In addition, since the second light-shielding member is used as a reinforcing member for the connection substrate, the number of new parts for reinforcing the connection substrate does not increase, and manufacturing steps for the new parts are not required. For this reason, production cost is not adversely affected.

As a concrete example of the second light-shielding member, the light-shielding member used in the above liquid-crystal display device, i.e., a sheet member comprising a polarizing plate and light-shielding properties can be directly used.

When a flexible substrate such as an FPC is used as the connection circuit substrate, the reinforcing effect becomes more remarkable.

As an example of the electronic device according to the present invention, in addition to a portable telephone, a PDA (Personal Digital Assistant), a personal computer, a car navigation system, and the like are known.

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a sectional view showing a main part of a first embodiment of a liquid-crystal display device according to the present invention.

Fig. 2 is a sectional view showing a main part of a second embodiment of a liquid-crystal display device according to the present invention.

FIG. 3 is a sectional view showing a main part of a third embodiment of a liquid-crystal display device according to the present invention.

Fig. 4 is a sectional view showing a main part of a fourth embodiment of a liquid-crystal display device according to the present invention.

Fig. 5 is a perspective view showing an example of the liquid-crystal panel portion of the liquid-crystal display device according to the present invention.

FIG. 6 is an enlarged view of a main part of a fifth embodiment, an electronic device, according to the present invention.

FIG. 7 is a view showing the fifth embodiment, the electronic device, according to the present invention.

FIG. 8 is a view showing a conventional liquid-crystal display device.

[BEST MODE FOR CARRYING OUT THE INVENTION]

(First Embodiment)

FIG. 1 shows a first embodiment of a liquid-crystal display device according to the present invention. This liquid-crystal display device has a pair of substrates 1 and 2 which are opposite to each other. Both substrates consist of, e.g., transparent glass. Stripe-shaped ITO (Indium Tin Oxide) electrodes 3 are formed on the inside surface (lower surface in FIG. 1) of the first substrate 1, and stripe-like ITO electrodes 4 are formed on the inside surface (upper surface in FIG. 1) of the second substrate 2. In this embodiment, the present invention is applied to a liquid-crystal display device of a simple matrix type. Therefore, the first substrate 1 and the second substrate 2 are joined to each other by a sealing agent 5 such that the ITO electrodes 3 and 4 are perpendicular to each other as shown in FIG. 5. As is well known, pixels for displaying a visible image are

formed at the crossing points between the electrodes 3 and 4 which crossing points are arranged in the form of a matrix. Referring to FIG. 1, a liquid crystal is filled in a space R surrounded by the first substrate 1, the second substrate 2, and the sealing agent 5.

As the material of the electrodes, any transparent electrode material, e.g., not only an ITO but also a tin oxide (SnO_2), may be used. As to the shape of the electrodes on a display surface, not only a stripe shape, but also special symbols (i.e., a symbol representing a function) as indicated by 10 in FIG. 5 may be used.

Polarizing plates 6 and 7 are fixed to the outside surface (upper surface in FIG. 1) of the first substrate 1 and the outside surface (lower surface in FIG. 1) of the second substrate 2, respectively. The light-transmission axes of the polarizing plates 6 and 7 are offset from each other by, e.g., 90°. A back light unit 15 is arranged on the outside (the lower side in FIG. 1) of the second substrate 2. The back light unit 15 comprises a light-guide plate 8 having an area corresponding to an effective display region D and an LED (Light Emitting Diode) 9 serving as a light source arranged on the left-end portion of the light-guide plate 8.

An end portion 1a of the first substrate 1 projects beyond the edge of the second substrate 2, IC output terminals 3a extending from the ITO electrodes 3 and IC input terminals 11 electrically connected to the output terminal of an external circuit substrate (not shown) are formed on the inside surface of the projecting portion 1a. A semiconductor element forming a driver IC 12 is electrically and mechanically directly fixed to a surface on which bump electrodes 13a and 13b and a circuit pattern are formed, i.e., on the first substrate 1, by an ACF 14 in such a manner that the so-called active surface 12a faces the first substrate 1. Surfaces of the driver IC 12 other than the surface joined to the first substrate 1 are covered with a light-shielding member 7a. In this embodiment, the polarizing plate 7 on the second substrate 2 side is extended to the region outside of the effective display region D, and the light-shielding member is constituted by the extended portion 7a. The polarizing plate 6 arranged on the first substrate 1 to which the driver IC 12 is fixed, extends to the projecting portion 1a of the first substrate 1 beyond the effective display region D, and the polarizing plate extended portion 7a operates as a light-shielding member on the active surface side of the driver IC 12.

Since the liquid-crystal display device of this embodiment is arranged as described above, when voltage application to the electrodes 3 and 4 is controlled by the driver IC 12 while light is emitted from the back light unit 15, a desired visible image is displayed in the effective display region D.

While the visible image is displayed as described above, part of the light emitted from the back light unit 15 tends irradiate the active surface 12a of the driver IC 12 through the upper and side surfaces of the semiconductor element 12 and the joint portion between the first substrate 1 and the semiconductor element 12. Depending on cases, sunlight passes through the first substrate 1 or passes around the end portion of the first substrate 1. Thereafter, the light tends to be incident on the active surface 12a through the upper and side surfaces of the semiconductor element 12 and the joint portion between the first substrate 1 and the semiconductor element 12.

In addition, light emitted from the back light unit 15 or sunlight tends to be directly incident on the active surface 12a through the first substrate 1. It is not preferable for the driver IC 12 that light is incident on the active surface 12a.

In this embodiment, progressing of the light which tends to be incident on the active surface of the driver IC through the upper and side surfaces of the driver IC 12 and the joint portion between the first substrate 1 and the semiconductor element 12 is blocked by the extended portion 7a of the polarizing plate 7, and the active surface 12a is shielded from light. The light-shielding member 7a for shielding the driver IC 12 from light is constituted as follows. That is, the polarizing plate 7 quite generally used in the liquid-crystal display device is increased in area, and the extended portion 7a of the polarizing plate 7 is simply arranged to cover the driver IC 12. Therefore, a specially complex processing step need not be performed to arrange the light-shielding member 7a, and the liquid-crystal display device is extremely economical with respect to the number of parts or the number of manufacturing steps.

Progressing of the light which tends to be incident on the active surface 12a of the driver IC 12 through the first substrate 1 is blocked by the extended portion 6a of the polarizing plate 6, and the active surface 12a is sufficiently shielded from light in practice. As a result, the driver IC 12 can be reliably prevented from misoperation due to light reception. Like the above light-shielding member 7a, the second light-shielding member 6a for shielding the active surface side of the driver IC 12 is constituted as follows. That is, the polarizing plate 6 quite generally used in the liquid-crystal display device is increased in area, and the polarizing plate 6 is simply fixed to the outside surface of the first substrate 1 when viewed from the driver IC 12. Therefore, a specially complex processing step need not be performed to arrange the second light-shielding member, and the liquid-crystal display device is extremely economical with respect to the number of parts or the number of manufacturing steps. When a light-shielding layer is formed between the driver IC 12 and the first substrate 1 as in the prior art, the light-shielding layer must be formed in a proper pattern in consideration of the problems of electric capacitance and electric insulation. However, the polarizing plate extended portion 6a operating as the light-shielding member in this embodiment can be formed in an arbitrary pattern which can exercise sufficient light-shielding performance. Therefore, the driver IC 12 can be reliably shielded from light.

(Second Embodiment)

FIG. 2 shows a second embodiment of a liquid-crystal display device according to the present invention. In this liquid-crystal display device, a light-shielding sheet member 26 operating as a second light-shielding member is adhered to a surface, which is opposite to a driver IC 12, of the first substrate 1 to which the driver IC 12 is joined. In addition, when the surface of the driver IC 12 other than an active surface 12a is covered with a resin mold 36, the resin mold 36 is used as the light-shielding member.

The second light-shielding sheet member 26 can be constituted by a flexible adhesive tape having black or another non-transparent color, a non-flexible adhesive sheet having black or another non-transparent color, or the like. In addition, the resin mold 36 can consist of an arbitrary resin material, having light-shielding properties, such as a thermoplastic resin or a thermosetting resin.

(Third Embodiment)

FIG. 3 shows a third embodiment of a liquid-crystal display device according to the present invention. In this liquid-crystal display device, one adhesive tape 46 having light-shielding properties and flexibility is adhered to the first substrate 1 such that the adhesive tape 46 is bent around the first substrate 1, thereby constituting a light-shielding member 46a on the substrate side and a light-shielding member 46b on the driver IC 12 side. According to this embodiment, when the very simple operation, namely adhering one adhesive tape 46 to both the front and rear surfaces of the first substrate 1, is performed, the driver IC 12 can be reliably shielded from light. When a tape material also having elasticity is used as the adhesive tape 46, the tape can be fitted on the driver IC 12 and the substrate 1 in a tight contact state.

(Fourth Embodiment)

FIG. 4 shows a fourth embodiment of a liquid-crystal display device according to the present invention. In this liquid-crystal display device, an adhesive tape 47 having light-shielding properties is stuck on the driver IC 12 to cover the driver IC 12, thereby constituting a light-shielding member 47. For the second light-shielding member on the substrate side, as in the first embodiment, a polarizing plate 6 quite generally used in a liquid-crystal display device is increased in area, and is simply fixed to the rear surface of the first substrate 1 when viewed from the driver IC 12.

(Fifth Embodiment)

FIG. 6 is a view showing the details of the connection portion of an electronic device according to the present invention, and FIG. 7 is a view showing the electronic device according to the present invention. The end portion 1a of the first substrate 1 projects beyond the edge of the second substrate 2, IC output terminals 3a extending from ITO electrodes 3 and IC input terminals 11 electrically connected to output terminals (not shown) of a connection circuit substrate 48 are formed on the inside surface of the projection portion 1a. The input terminals (not shown) of the connection circuit substrate 48 are connected to a main substrate 49 for sending external input signal input from an external keyboard 50 to the driver IC 12. The driver IC 12 forming a semiconductor element is electrically and mechanically directly fixed to the first substrate 1 by an ACF 14 in such a manner that the so-called active surface 12a faces the first substrate 1. Surfaces of the driver IC 12 other than the surface joined to the first substrate 1 are covered with a resin mold 36 serving as a light-shielding member. The resin mold 36 can consist of an arbitrary resin material, having light-shielding properties, such as a thermoplastic resin or a thermosetting resin. A light-shielding sheet member 26 operating as a second light-shielding member is adhered to a surface of the first substrate 1, which is opposite to that to which driver IC 12is joined. The light-shielding sheet member 26 can be constituted by a flexible adhesive tape having black or another non-transparent color, a non-flexible adhesive sheet having black or another non-transparent color, or the like. The light-shielding sheet member 26 is arranged to extend beyond the edge of the first substrate, and the extending portion is stuck on the connection circuit substrate 48 to overlap it. In this manner, the light-shielding sheet member 26 operates to reinforce the connection between the connection circuit substrate and the first substrate.

In this embodiment, the resin mold 36 is used as a light-shielding member, and a light-shielding adhesive tape is used as the second light-shielding member. However, as the light-shielding member and the second light-shielding member, both the light-shielding member and the second light-shielding member which are described in the first to fourth embodiments can be used, as a matter of course.

(Other Embodiments)

The present invention has been described with reference to the preferable embodiments. However, the present invention is not limited to these embodiments, and the present invention can be variously modified within the range defined by the claims.

For example, the present invention is not limited to a liquid-crystal display device of the simple matrix type, but may also be applied to a liquid-crystal display of an active matrix type. The method of joining the driver IC 12 to the substrate is not limited to the method using an ACF, and an arbitrary joining method can be employed. As a back light unit, not only a unit constituted by an

LED and a light-guide plate, but also any arbitrary light-emitting means such as an EL (Electro Luminescence) device can be used. In each of the embodiments shown in FIGS. 1 to 4, the back light unit 15 is arranged on the substrate 2 side opposite to the substrate 1 to which the driver IC 12 is joined. In place of this arrangement, the back light unit 15 may be arranged on the substrate 1 side to which the driver IC 12 is joined.

As the fifth embodiment, a portable telephone is exemplified. However, the present invention can be applied to not only a portable telephone but also a PDA (Personal Digital Assistant), a personal computer, a car navigation system, and the like.

Claims

1. A liquid-crystal display device having a pair of substrates which are opposite to each other through a liquid crystal, and a semiconductor element which is directly joined to at least one of said substrates,
   characterized in that a portion other than a surface, which is joined to one of said substrates, of the surfaces of said semiconductor element is covered with a light-shielding member portion.

2. A liquid-crystal display device according to claim 1, characterized in that a second light-shielding member for shielding light being toward said semiconductor element is arranged on a surface, opposite to the surface, to which said semiconductor element is joined, of the surfaces of one of said substrates.

3. A liquid-crystal display device according to claim 2, characterized in that a plurality of pixels having no active element are arranged between said pair of substrates.

4. A liquid-crystal display device according to any one of claims 1 to 3, characterized in that said semiconductor element is joined to one of said substrates such that an active surface of said semiconductor element faces said substrate.

5. A liquid-crystal display device according any one of claims 1 to 4, characterized in that a polarizing plate is arranged on a surface of the other of said substrates, and said light-shielding member is constituted by a portion located outside an effective display region of said polarizing plate.

6. A liquid-crystal display device according to any one of claims 1 to 4, characterized in that said light-shielding member is a molding resin which covers the surface of said semiconductor element joined to said substrate.

7. A liquid-crystal display device according to any one of claims 2 to 4, characterized in that said light-shielding member and said second light-shielding member are constituted such that a light-shielding tape having light-shielding properties and flexibility is adhered to one of said substrates to be bent around said substrate.

8. A liquid-crystal display device according to any one of claims 2 to 4, characterized in that a polarizing plate is-arranged on a surface of one of said substrates, and said second light-shielding member is constituted by a portion located outside an effective display region of said polarizing plate.

9. A liquid-crystal display device according to one of claims 2 to 6, characterized in that said second light-shielding member is constituted such that a planar sheet member having light-shielding properties is adhered to a surface of one of said substrates.

10. An electronic device in which a liquid-crystal display device having a pair of substrates which are opposite to each other through a liquid crystal and a semiconductor element which is directly joined to at least one of said substrates and a main body having a main substrate for sending an external input signal to said semiconductor element are connected to each other by a connection circuit substrate,
    characterized in that a portion other than a surface, which is joined to one of said substrates, of the surfaces of said semiconductor element is covered with a light-shielding member.

11. An electronic device according to claim 10,
    characterized in that a second light-shielding member for shielding light being toward said semiconductor element is arranged on a surface, opposite to the surface, to which said semiconductor element is joined, of the surfaces of one of said substrates to extend to an outside position of one of said substrates, and
    the extended portion of said second light-shielding member is arranged to overlap the connection circuit.

FIG. 1

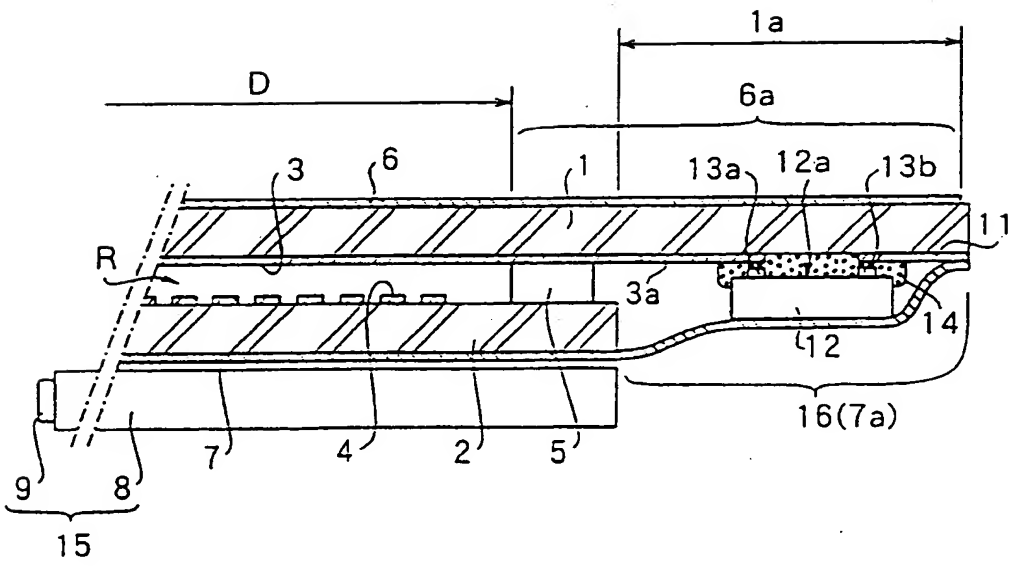


FIG. 2

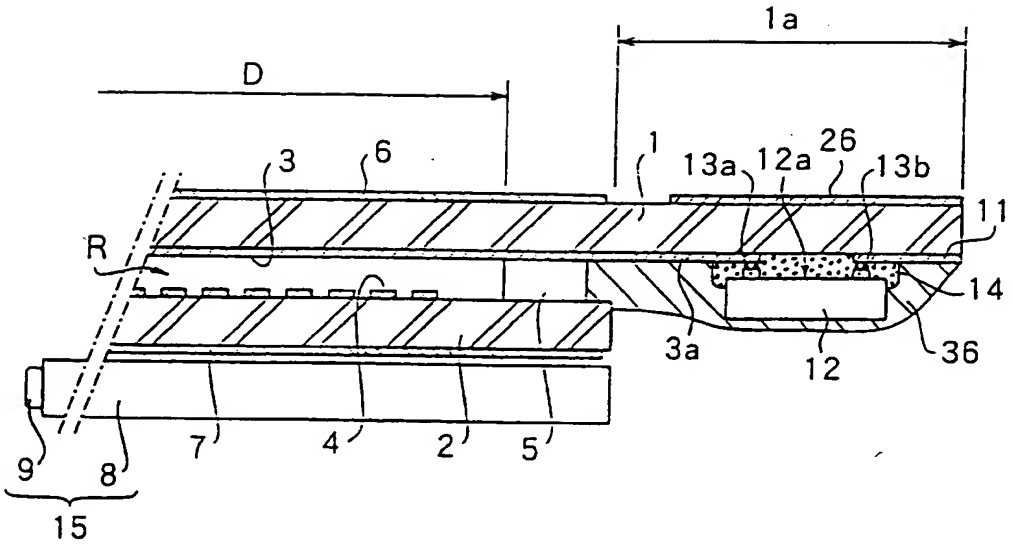


FIG. 3

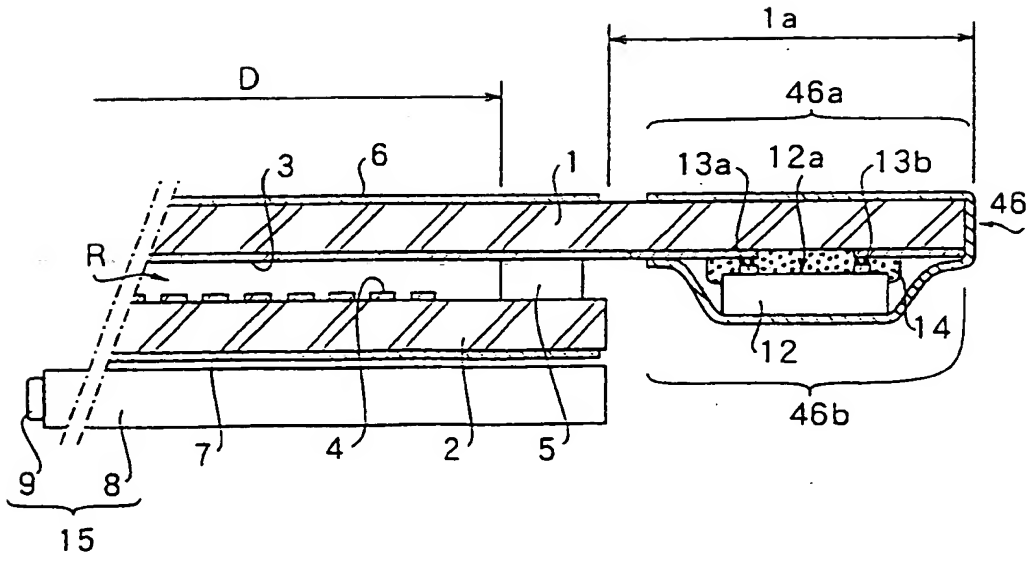


FIG. 4

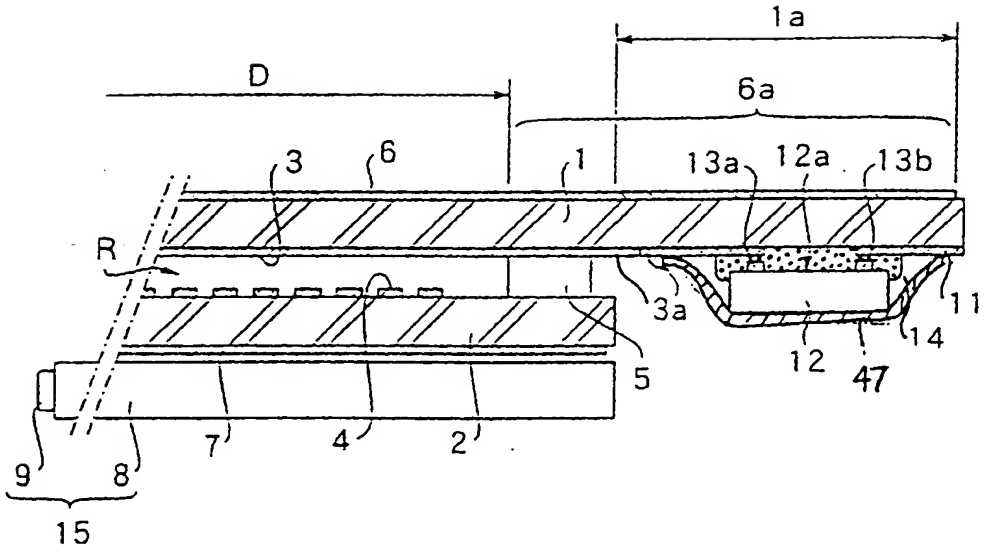


FIG. 5

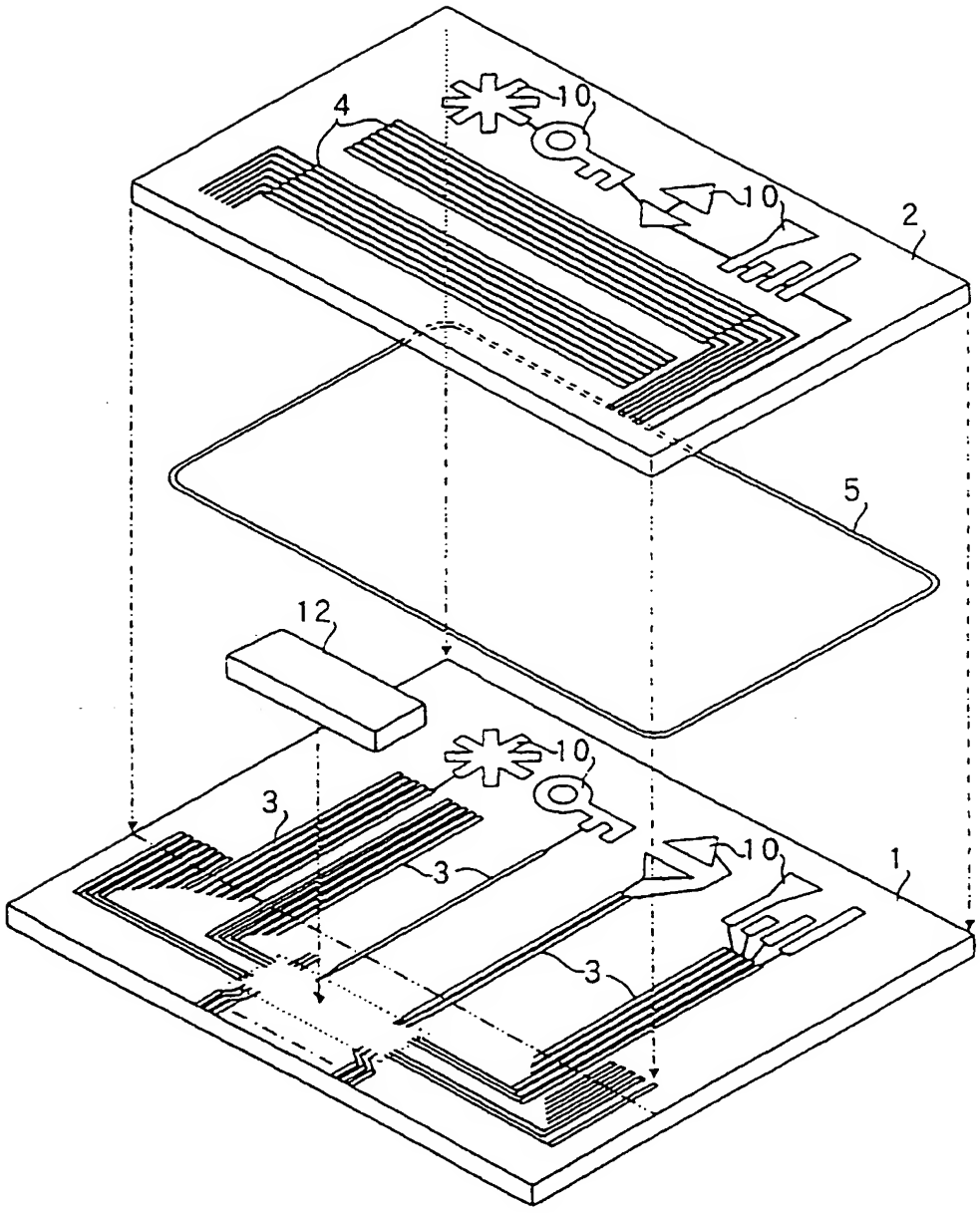


FIG. 6

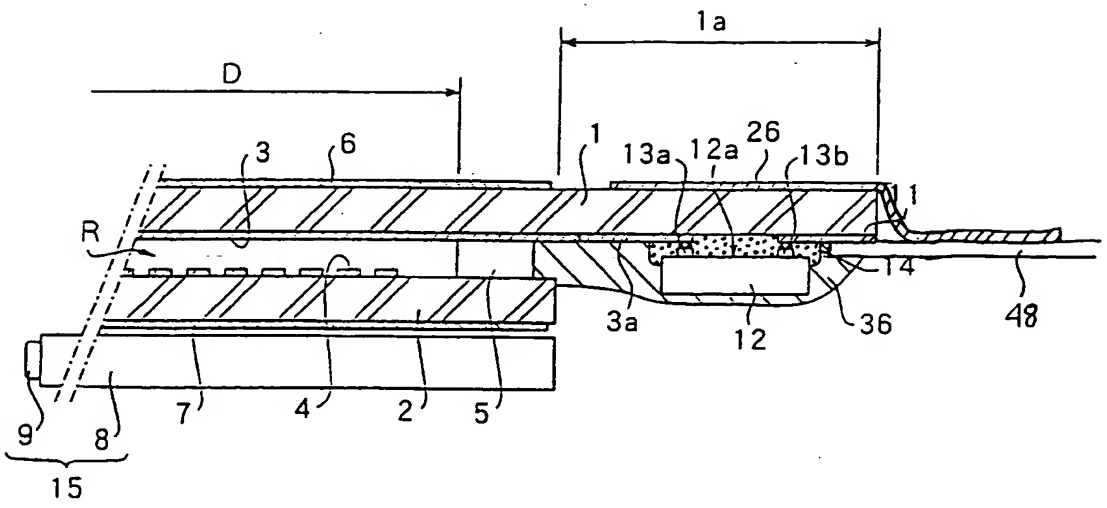


FIG. 7

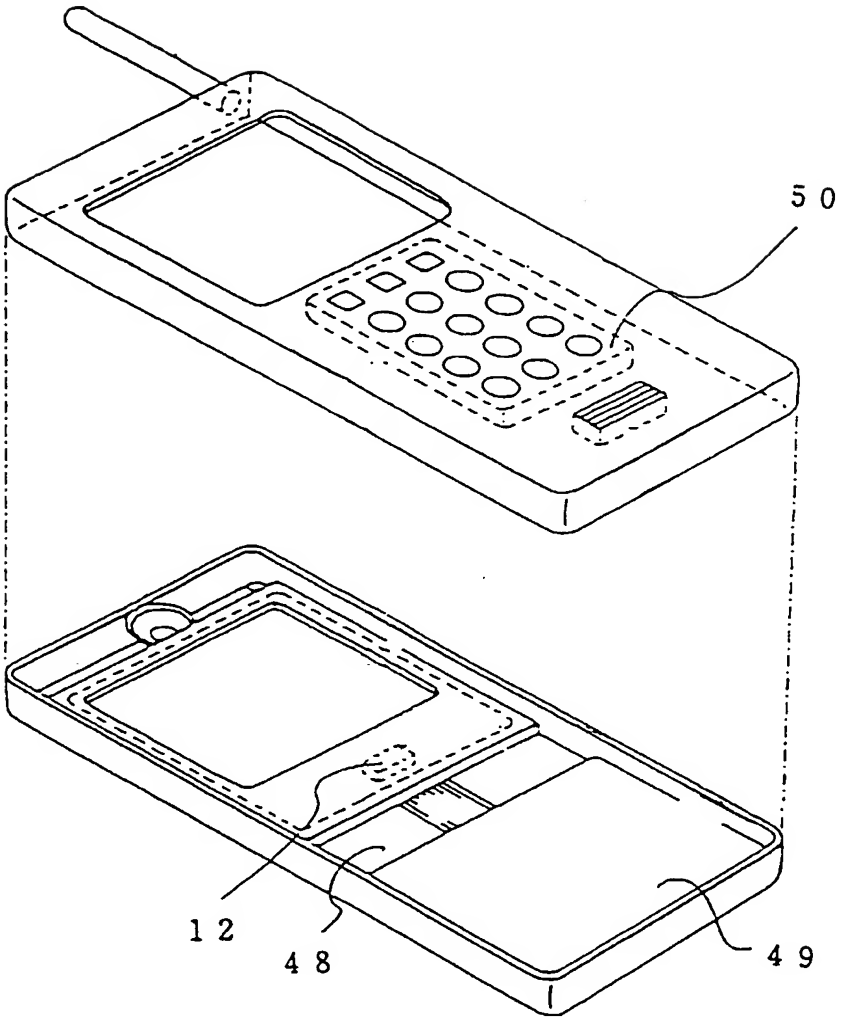
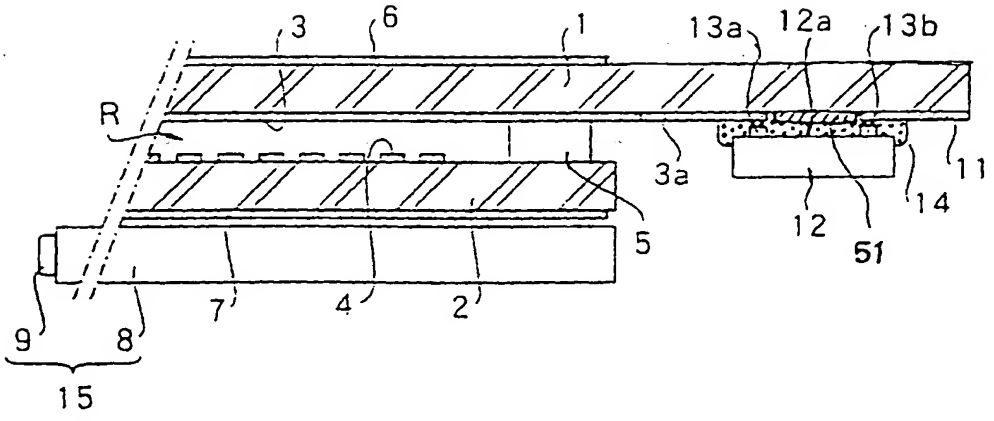


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP97/02543

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl^6 G02F1/1345, G02F1/1335

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl^6 G02F1/1345, G02F1/1335

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926 - 1996
Kokai Jitsuyo Shinan Koho 1971 - 1996

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X X X Y A	JP, 3-10224, A (Sharp Corp.), January 17, 1991 (17. 01. 91), Page 4, upper right column, lines 10 to 16 Page 3, lower right column, lines 3 to 9; Fig. 4 & EP, 0402106, A2	1-2, 4, 9 3 7 6, 8, 10-11 5
X Y	JP, 5-333359, A (Sharp Corp.), December 17, 1993 (17. 12. 93), Page 2, left column, lines 42 to 45; Fig. 6 (Family: none)	6 6
Y	JP, 2-277024, A (Seiko Epson Corp.), November 13, 1990 (13. 11. 90), Fig. 1 (Family: none)	8, 10-11
Y	CD-ROM of the specification and drawings annexed to the written application of Japanese Utiliy Model Application No. 74989/1991 (Laid-open No. 27726/1993)(Sanyo Electric Co., Ltd.),	10 - 11

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
October 15, 1997 (15. 10. 97)	October 28, 1997 (28. 10. 97)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP97/02543

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	April 9, 1993 (09. 04. 93) (Family: none)	
A	JP, 7-175059, A (Casio Computer Co., Ltd.), July 14, 1995 (14. 07. 95) (Family: none)	8

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